Wild medicinal and food plants used by communities living in *Mopane* woodlands of southern Angola: Results of an ethnobotanical field investigation

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ABSTRACT

Ethnopharmacological relevance: *Mopane* woodlands play an important role in the livelihood strategies of local populations; however, they have been scarcely investigated by ethnobiologists and very little is currently known about plants traditionally used by local communities, especially about medicinal plants.
Aim of the study: Our investigation was aimed to document ethnobotanical knowledge in seven communities living in conditions of extreme poverty in a *Mopane* area of southern Angola (Namibe province). We focused on plants used as medicines and/or food, in order to highlight the role of wild plants in the livelihood of local communities, and possibly to find out plants with potential pharmacological interest.
Methods: Ethnobotanical data were recorded through semi-structured interviews, filed in a database and quantitatively analyzed. The following synthetic indexes were used: Cultural Importance index (*CI*), Informant Consensus Factor (*FIC*), Fidelity Level (*FL*).
Results: Sixty-six informants (26 males, 40 females) were interviewed. A total of 1247 citations were recorded, concerning 132 *ethnospecies* (folk taxonomic units not necessarily corresponding to single botanical species); 104 were identified at different taxonomic levels. For medicinal purposes, 116 ethnospecies and 20 different uses (650 citations) were reported; for food purposes, 33 ethnospecies and 8 different uses (597 citations). The main used parts resulted to be fruit (471 citations; 21 ethnospecies), followed by underground organs (288, 82) and leaves (175, 41). According to *CI* values, *Berchemia discolor*, *Ximenia americana* var. *americana* and *Adansonia digitata* have the highest cultural value in the investigated communities. All of them are woody plants, as well as most of the identified ethnospecies (trees 34.6%, shrubs 32.7%, perennials 21.2%, annuals 8.7%, others 2.8%). Medicinal plants are especially used to treat disorders of the gastrointestinal tract (52 ethnospecies, 205 citations), obstetric/gynecological troubles (27, 40) and colds and respiratory tract diseases (25, 54). The highest values of *FIC* were recorded for body care (*FIC*=1.0), circulatory diseases (*FIC*=0.91), malaria (*FIC*=0.81) and digestive disorders (*FIC*=0.55). The plants showing the highest informants' consensus (*FL*) were *Myrothamnus flabellifolia* used to treat colds and respiratory diseases (*FL*=100%), *Terminalia prunioides* for digestive diseases (93%) and *Euphorbia subsalsa* for backache (86%). For five plants cited as medicinal by the informants, no reports were found in the consulted ethnobotanical and ethnopharmacological literature; many uses of several already known medicinal plants were also unrecorded. Food products obtained from wild plants include fresh fruit (20 ethnospecies, 287 citations), alcoholic (11, 107) and non-alcoholic (10, 44) beverages, *massa*, i.e. a kind of mash, (4, 65), vegetables (10, 40), and others.
Conclusions: Results show that people living in *Mopane* communities of southern Angola hold a valuable knowledge of the uses of plant resources and that some of the plants cited by the informants represent an important component of the local livelihood strategies. We also found some plants worthy of more indepth investigations on their possible pharmacological activity, including: (i) those used to treat diseases which reached the highest *FIC*, like malaria and various disorders of the gastrointestinal tract; (ii) plants with a high *FL*; (iii) plants not previously reported in ethnomedical literature, especially those cited by different informants; (iv) plants with possible nutraceutical or pharma-food properties, i.e. plants with considerable contents in vitamins and/or micronutrients and plants whose food and medicinal uses are closely related.

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1. Introduction

Traditional Ecological Knowledge (TEK) reflects the perception of local environment by indigenous people, as well as important aspects of their history, culture and socio-economic organization. TEK can be interpreted as a complex of cultural tools developed by local communities through the centuries in accordance with their natural and social environment, owned and controlled by them. It proved to be an important component of the adaptation dynamics-that is, the ability of a living system, also including socio–ecological systems, to adjust responses to changes in internal demands and in external factors. This means that TEK may play an important role in minimizing the impact of disturbances, therefore affecting resilience of human communities, especially those living in harsh environments (Begossi, 1998; Gómez-Baggethun et al., 2012). It is estimated that 68% of Angolan population lives below the poverty line and 15% in conditions of extreme poverty; the situation is particularly severe in rural areas, where 94% of households can be categorized as poor (IFAD, 2014). Moreover, child and maternal mortality rates are among the highest in the world, and are nearly 70% higher in rural than in urban areas (UNICEF, 2013). Because of widespread malnutrition, more than one-quarter of Angolan children are physically stunted. Malaria, diarrhea, respiratory infections and neonatal diseases compounded by low birth weight are major killers of children; hemorrhages, obstetric infections, obstructed labors are responsible for 80% of deaths of women during pregnancy or immediately after birth (UNICEF, 2013). Within this context, biological resources offered by the environment can act as a safety net in poor people livelihoods, providing food, medicine and other resources. The potential relative contribution of forest products to livelihood is higher for poor and marginalized people living in remote communities of southern regions of Angola, where a markedly dry and variable climate undermines the viability of agriculture as a livelihood option.

The aim of this study was to assess local knowledge related to traditional plant uses in the *Mopane* woodlands located in Bibala and neighboring zones, an area of the south-east part of Namibe province poorly explored from an ethnobiological point of view, and to discuss their role in the health practice and the livelihood of local communities. Although different kinds of ethnobotanical uses were recorded during field work, in this paper only results concerning plants used for medicine and nutrition are presented. As observed by Heywood (2011): "approaches to issues of human nutrition and health have become increasingly interdisciplinary, reflecting the linkages between biodiversity, agriculture, food production, nutrition, diet and human health". *Mopane* woodlands are scrub or savannah woodlands dominated by *Mopane* trees-*Colophospermum mopane* (Kirk ex Benth.) Kirk ex J. Léonard-occurring in the arid lowlands of southern Africa, between latitudes 9°S and 25°S (Makhado et al., 2014). In Angola, *Mopane* trees grow over wide areas, in a low, thorny bushveld along the border between southern Angola and northern Namibia at around 700–1000 m in elevation. The dry climate of these environments is not favorable to agriculture and most farmers work as nomadic pastoralists, moving about both on a daily and seasonal basis according to fodder availability.

Despite its ecological importance (Mittermeier et al., 2003), until now the *Mopane* ecosystem has only received marginal attention by biologists and by ethnobiologists in particular.

Few studies have described the multifunctional role of these woodlands (Sebego, 1999; Makhado et al., 2009, 2012), providing a list of local NTFPs (Non-Timber Forest Products) and discussing their importance in the livelihood of rural populations. The lack of ethnobotanical information is particularly pronounced for the Angolan *Mopane* ecoregion; some data can be obtained from Davies (1994), Bossard (1996), Melo and Conceição (2005), Melo (2008) and from studies carried out in northern Namibia (Chisembu and Hedimbi, 2010; Cheikhyoussef et al., 2011a, b; Cheikhyoussef and Embashu, 2013).

Three factors make the Angolan *Mopane* ecoregion a particularly interesting area for recording traditional botanical uses and assessing their role in sustaining the adaptive capacity of local communities: (i) the remarkable floristic richness of the biogeographical context, with a relatively high number of endemic species (Mittermeier et al., 2003); (ii) the historical isolation of local communities, only marginally affected by the civil war (1975–2002); such isolation facilitated the conservation of local cultural heritage; (iii) the extreme drought conditions, which make agriculture a high-risk, low-return activity in this area, emphasizing the importance of wild plants as a source of food, medicines and other primary necessities. Repeated droughts experienced in recent years negatively impacted livelihoods in the south-western parts of Angola, particularly in the provinces of Namibe and Cunene (UNICEF, 2013). In these areas, agricultural harvests in the period 2012–2014 were estimated to range from 50% to 70% below average. More than 20% of households in Namibe province suffered from food shortage caused by reduced agricultural production; moreover, people were also unable to purchase several non-food items, such as medicines, blankets, clothes and personal hygiene items.

2. Materials and methods

2.1. Study area

All the investigated communities (Fig. 1) lie in the municipality of Bibala, approximately 200 km NE from Namibe, the administrative center of the province. According to Le Houérou (2009), this is an arid to hyper-arid tropical region with relatively low temperatures and little annual variation in temperature, shaped by the local effects of the cold Benguela current. In the study area, the climate is strongly seasonal, with an average annual temperature of 21.6 °C and an average annual rainfall ranging from 300 to 600 mm. The rainy hot season occurs from January to March, while the long dry winter lasts nine months. The soils are paraferralitic of medium or coarse texture (Diniz, 1991). The vegetation is mostly composed of *Mopane* woodlands, with *Colophospermum mopane* as the dominant species.

Farming is hard in these communities, due to the uncertainty of rainfall and the low levels of technology. It is typically conducted by hand, using simple tools and no chemical inputs; 'milho' (*Zea mays* L.), 'massambala' (*Sorghum bicolor* (L.) Moench), 'massango' (*Pennisetum glaucum* (L.) R.Br.) and 'feijão macunde' (*Vigna unguiculata* (L.) Walp.) are the main crops. For their subsistence, people depend mainly on livestock breeding and charcoal production. Livestock is considered by people as their main survival means and income source, but is also regarded as a wealth symbol. Although making and selling charcoal is prohibited in most